Claims

1. A low temperature electrochemical method for removing specie.X from compound MX, comprising the steps of:

   A. forming an electrolysis system comprising a MX cathode, an anode, and a non-aqueous ionic liquid electrolyte;

   B. passing a current through said system at a voltage determined to remove X from MX;

   C. isolating the reaction product resulting from removal of X from MX.

2. The method according to claim 1, where M is selected from the group consisting of a metal, a metal compound, or a semi-metal compound.

3. The method according to claim 1, where M is selected from the group consisting of Ti, Si, Ge, Zr, Hf, Sm, U, Al, Mg, Nd, Mo, Cr, Li, La, Ce, Y, Sc, Be, V or Nb, or alloys thereof or mixtures thereof.

4. The method of claim 1or10, wherein Xis selected from the group consisting of O, C, N, S, P, As, Sb, or a halide.

5. The method according to claim 1or 10, wherein X is oxygen.

6. The method according to claim 1 or 10, wherein said non-aqueous solvent is a chloroaluminate system based on nitrogen heterocyclic cations or functional equivalent thereof.

7. The method according to claim 1 or 10, wherein said non-aqueous solvent is selected from the group consisting of mono and dialkylimidazolium salts.

8. The method according to claim 1 or 10, wherein said non-aqueous solvent is a mixture of 1-ethyl-3-methylimidazolium chloride and aluminum chloride.

9. The method according to claim 1 or 10, wherein said solvent is 1-ethyl-3-methylimidazolium tetrafluoroborate.

10. A low temperature electrochemical method for removing O from TiO_2, comprising the steps of:

A. forming an electrolysis system comprising a TiO_2 cathode, an anode, and a non-aqueous ionic liquid electrolyte;

B. passing a current through said system at a voltage selected to remove O from said TiO_2;

C. isolating the reaction product resulting from the removal of O from TiO_2.